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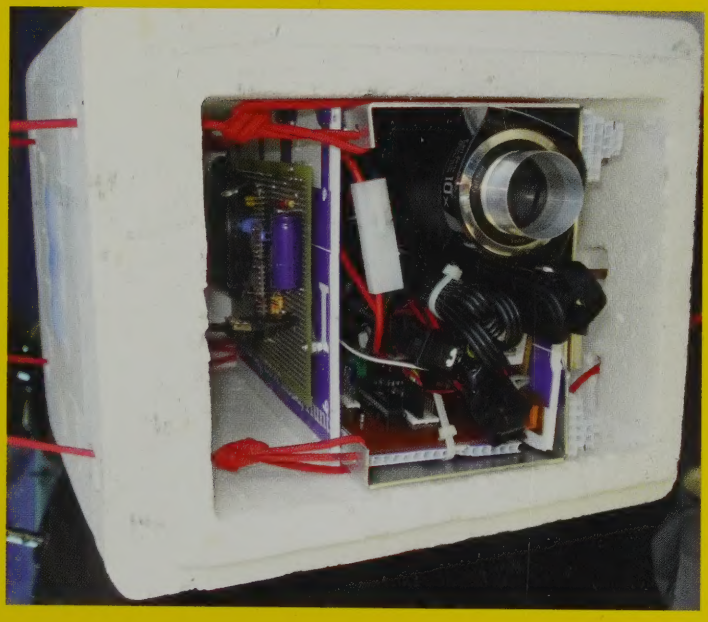
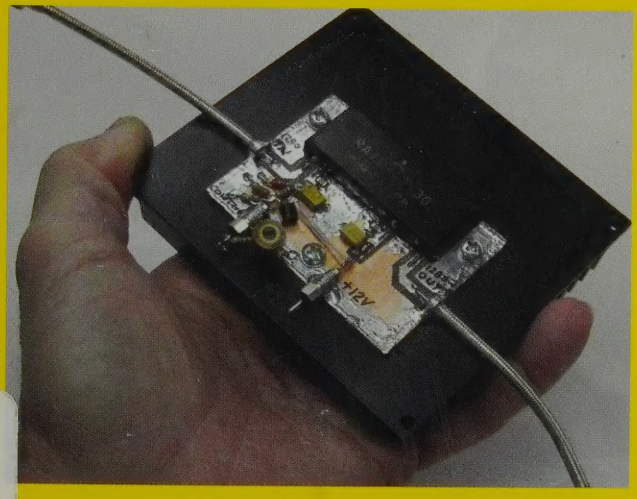
Amateur Television Quarterly

Hi-Def ATV from the Edge of Space



Build a Power Amp for 900/1200 MHz

EARLY TV HISTORY



If You Move

Please send us your NEW ADDRESS! We pay 70 cents for each returned ATVQ. And we are usually nice and send another copy to your new address which costs us $1.29. Please help us from having to do this. Thanks!

AMATEUR TELEVISION QUARTERLY

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Amateur Television Quarterly
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Sync Buzz Editorial

- Bill Brown WB8ELK and Mike Collis WA6SVT

Digital ATV

Is digital ATV (DATV) the future of Amateur Television?

Mike and I foresee a transition period where both modes will coincide side by side similar to the transition period for broadcast TV. The good news is that there is no FAA mandated date for ceasing analog ATV like there was for commercial broadcast TV.

We can expect the continuation of good old analog ATV in the near term. The abundance of cheap analog surplus consumer equipment along with formally expensive commercial modulators and demodulators selling for pennies on the dollar on eBay will keep us in the world of analog TV for awhile.

While analog ATV may be with us for quite some time, digital ATV will become the real future and provide for some exciting experimentation. As boards, modules and IC chipsets become more widely available due to the existing consumer market, we can expect DATV boards and modules to come down in price to allow more of us to participate in this exciting mode.

In future issues of Amateur Television Quarterly, we will be focusing on these advances and will share information about what other groups across the World are doing for digital ATV.

ATVQ can provide a forum for DATV discussion and technical sharing. We'd like to hear from you about DATV formats and circuits that you have tried and will also share information with links on the ATVQ website:

www.atvquarterly.com

Note: To catch up on our editorial calendar and to keep the Post Office happy, we have skipped the Fall 2009 issue and jumped to the Winter 2010 issue. Not to worry though, we have adjusted all subscriptions up one issue so you will still be getting your full subscription.

- Bill and Mike

Space Hardware Club ATV Balloon

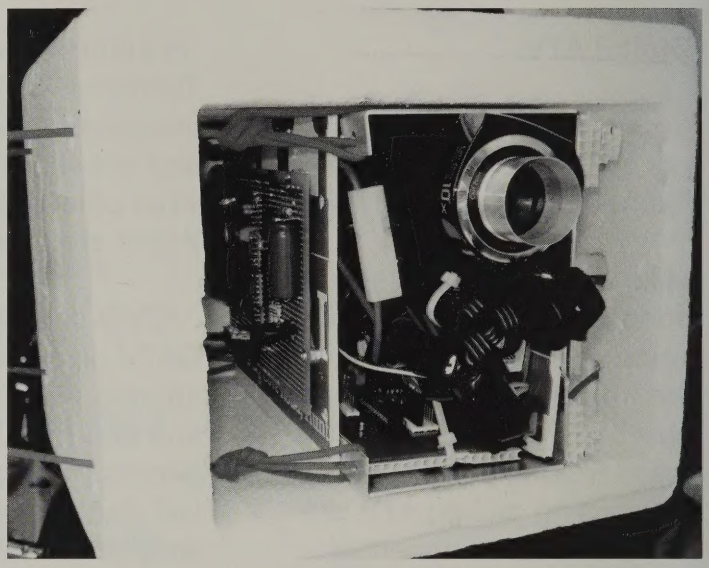
HD ATV from the edge of Space

- Bill Brown WB8ELK

The Space Hardware Club of University of Alabama, Huntsville (UAH) has been flying a number of unique high altitude balloon experiments. The club members meet two nights each week to work on their experiments and often launch a couple of balloons each semester. One of their payloads last year consisted of human and mouse nerve cells in an environmental chamber to see the effects of a trip into the stratosphere. The cells survived! UAH also flies Balloonsats as part of the Electrical Engineering senior design class but the Space Hardware club is unique in that students of any major can participate.

This past Fall on a beautiful October day, the SHC students launched a high-definition camcorder that also downlinked live video. The fast-scan amateur television (ATV) transmitter section put out 3 watts

on the 70cm band into a horizontally polarized Little Wheel antenna. In addition, there were several APRS transmitters on 144.39 and 144.34 MHz for tracking



Hi-Def SONY camcorder with 3 watt Videolynx ATV transitter on 427.25 MHz.

the balloon's position during flight.

The calm winds allowed a picture perfect liftoff as the students watched their payload rise high above Huntsville, Alabama. Barry Lankford N4MSJ brought his portable ATV receiver and antenna to watch the video during the flight. In addition, the ECE department at UAH has allowed the Space Hardware Club to set up a great ground station in a room on the second floor that has roof access for their antenna system. The az/el rotor system combined with some custom programming of their ground station computer allows the antenna to track the balloon by decoding the APRS downlinked position and altitude, calculating the azimuth and elevation bearings and automatically steering the antennas toward the balloon throughout the flight.

This first flight of their ATV system had some antenna problems (the Little Wheel had been beaten up pretty badly during a number of earlier missions) so only a few minutes of live ATV signals were received. However, they did get some beautiful high-definition video recorded on the camcorder's memory

SHC Students ready to launch
(l to r): Mark Becnel, Bob Hawkins, James Mulroy, Paul Watts and Jennifer Hunt

Barry N4MSJ with his portable ATV system

card.

Jason KG4WSV did some repair work on the Little Wheel and the club members flew the payload again a few weeks later from the Sparkman Middle School with excellent full-color live video received by many ATV stations across the Southeast. I was able to receive that flight with nothing more than a 3-element handheld Arrow Antenna hooked up to an Icom IC-R3 radio in TV mode throughout the majority of the flight. Hank W4HTB had color video reception from over 200 miles distance in Bowling Green, Kentucky and also linked his received video onto the BATC's streaming video website (www.batc.tv). The balloon burst at peak altitude was quite spectacular, we could clearly hear the balloon pop and were treated to the sound of the air rushing by the payload as it started its rapid descent in the near-vacuum of the edge of Space.

The final portion of the parachute drop back to Earth was quite exciting and a bit nerve-wracking as the payload came down only a few hundred feet from Alabama's equivalent of the Grand Canyon (Little River Canyon State Park). Fortunately, a cliff-hanging recovery was not needed as it managed to land in a tree not far from a road near the edge of the canyon.

For more info and announcements of future flights from the Space Hardware Club, you can visit them at:

http://spacehardware.uah.edu.

Cont. on Page 8

Launch of Earth Day ATV balloon by the Space Hardware Club

Space Hardware Club president Eric Becnel with the Az/El antenna system on top of the UAH ECE building.

Space Hardware Club antennas are circularly polarized on 144, 434, 915 and 1200 MHz bands and are controlled by a Yaesu G-5400B Az/El Rotor.

Philip Sauvey KC9RBG and Blake Parker man the Space Hardware Club ground station at UAH

ATV reception using an ICOM R-3 and a 3-element handheld Arrow Antenna from over 50 miles away.

The Tech Guy is IN

- Mike Collis WA6SVT

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Digital ATV is becoming the topic of discussion now and so many questions are being asked. I would like to feature some items of discussion for this issue of the Tech Guy and share some of my experience with broadcast digital television covering both news gathering microwave QPSK, QAM, COFDM and over the air 8VSB modulation systems.

One of the most asked questions are what modulation should we use? Art Towslee's covered this well in his DATV article in the summer issue and so far QPSK is the current modulation used in Europe and the ATCO's Columbus Ohio ATV repeater. Let's look at major digital and analog modulation and its advantages and disadvantages.

Analog TV:
NTSC, PAL or SECAM via Amplitude Modulation is the oldest ATV modulation used. 9 MHz occupied bandwidth for NTSC and 10 to 12 MHz for PAL depending on the frequency of the aural subcarrier.

In the case of NTSC, sync bars detected at -103 dBM and P-1 picture where you could copy a large call sign displayed took -97 dBM while snow free takes -61 dBM which allows a linear transition from detection of signal to snow free as illustrated in Art's DATV signal comparison.

The linear signal strength degradation made it easy for ATV DXing and aiming of antennas. Resolution was limited to about 420 lines on NTSC and over 500 for Pal, the primary limiting factor is the receiver's IF filter. QRM can cause a herringbone pattern in the picture at -37 dB below desired signal and at about -13 dBM below desired signal cause extreme distortion and loss of sync.

NTSC, PAL or SECAM via VSB is the same as AM with adding filtering in the transmitter to reduce amplitude at -0.75 MHz below visual carrier and band stop at -1.25 MHz below the visual carrier this reduced bandwidth to 6 MHz for NTSC systems and 7 to 8 MHz for PAL systems depending on their aural carrier.

Reception is basically the same as the receiver is same used for both AM and VSB. Usually most stations and ATV repeater outputs transmitting VSB upgraded to a separate aural carrier to allow stronger signal level and good audio quieting to stations receiving less than snow free pictures.

FM modulation became popular in Europe first then the rest of the world. NTSC, PAL and SECAM can be used with FM modulation. Broadcast TV until recently exclusively used it for both studio to transmitter links, intercity relay and ENG (news truck and helicopter) mobile links. This was done at much higher resolution, signal to noise ratio was much better than AM or VSB on moderate strength signals and with the FM capture affect QRM if about 10 dB below the desired picture or lower was not seen in the picture.

Bandwidth was in the 12 to 22 MHz range depending on type video used and the aural subcarrier frequency and number of subcarriers used. Signals could be detected at -92 dBM and by -87 dBM would reach P4 and -85 dBM P4.9 levels above this level; the video signal to noise improves more linearly. FM ATV still allowed adjusting antennas to peak up on the signal but the signal range was not linear anymore but gave about 10 dB range. Video deviation was set to 4 MHz for ground based systems and satellite was 11 MHz and bandwidth higher at 36 MHz.

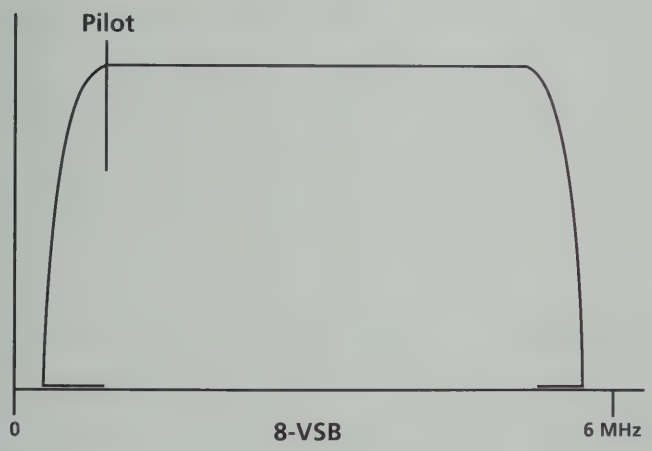
FM was not as popular for ATV DX as it took 11 dB more signal than AM to detect a signal and FM took too much bandwidth to allow use on 70 CM band and path loss is also 9 dB more on 23 CM band where FM ATV can be accommodated. FM does allow snow free reception at longer distances than AM even with the difference in path loss between 70 and 23 CM bands.

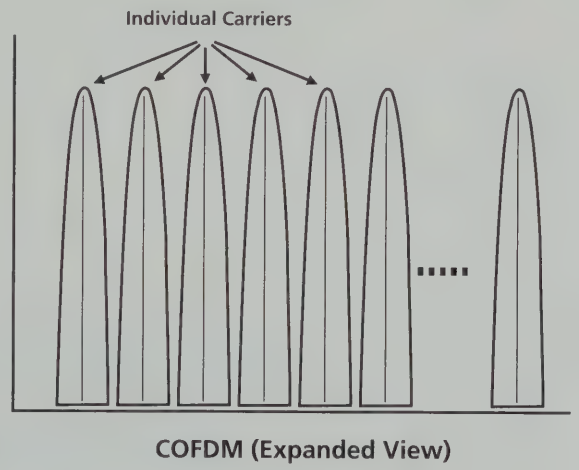
Digital TV:
Digital video modulation has four primary modulation types with many subcategories. They are QPSK,

QAM, 8VSB and COFDM, before we get deeper into the modulation we must talk about the video. Video from a camera is analog, it is then amplified and converted to digital in the camera or an existing source is converted to digital.

We now have two major types of digital video: Standard and high definition with many different types here and you would think the decades old NTSC,PAL and SECAM format wars were gone. They are still here although no big deal for conversion as most chip sets can take them all to standard definition digital. High definition has many types we will cover soon.

Analog video as well as the raw video from a CCD digital camera is quantized usually at a rate four times or greater than the highest analog frequency converted into a digital word for each point along the wave in the signal to express its amplitude value the word is timed to know its location. For color this is done for each primary color.





The words and timing are formed into packets of data with some added housekeeping data occupying 270 megabits. Any analog information between the quantizing sample points is discarded so some of the original picture is now lost forever but not usually noticed as the points are close enough together for connecting the dots as I call it in the video monitor fills in between the sample points.

This signal is much too wide to transmit other than down a cable or fiber. To be useful, the signal has to be compressed by a large value to transmit over the air. So far the uncompressed video has almost no delay or lag. MPEG-2 is the current broadcast compression used. The data is analyzed two times, first to minimize duplication of the same color and luminance value for example a blue sky or large solid object is condensed in to just a few words of value and starting and ending location.

The second process is movement so a moving object needs to just resend words to what direction it moved. This way a talking head would not use that many words but a camera panning during an auto race would use many times the words to describe the picture. This processing time now delays the picture about a second to a few seconds depending on the content in the picture and bandwidth of transmission. Hi Definition video is handled in a similar manor but its uncompressed bandwidth is 1.5 gigabits about 6 times greater that standard definition for full 1080P HD and 720P is about half the bandwidth.

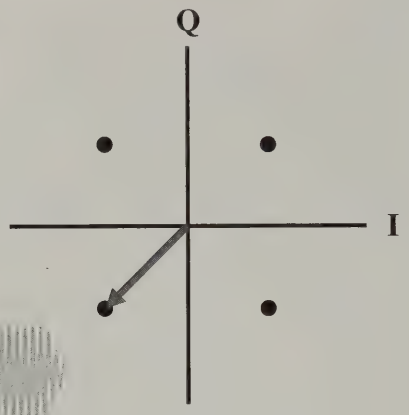
Audio is digitized in a similar way in its conversion and synced to the picture packets to minimize lip sync issues and occupies a fraction of bandwidth as the video and is usually added together with the video in a multiplexor prior to digital modulation.
Now that you have had a chance to see the basics (I did not want to get to the very detailed way this is done as it would fill a textbook) of how we obtain digital video, now let's discuss how we can modulate it onto an RF carrier. We could just AM or FM modu-

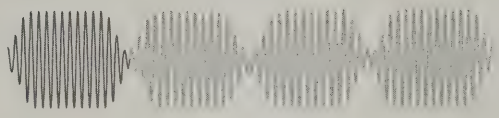
late the MPEG-2 video but the 2 to 4 megabit standard definition and 12 to 19 megabit needed for high definition with its sharp waveform would occupy too much RF spectrum.

QPSK Constellation

Cisco.com

Symbol Transmitted	Carrier Phase	Carrier Amplitude
00	225°	1.0
01	135°	1.0
10	315°	1.0
11	45°	1.0





Most digital modulation rounds off the sharp edges of the MPEG packets, add some error correction to help with path issues.
FSK is very robust but not used as the RF bandwidth is too great. QPSK is next with four times greater capacity than FSK. This is done with two side by side "phase" and two vertical "Amplitude" levels. QPSK was the choice for pushing digital through a satellite's almost linear transponders that prior to digital was used for FM analog relay. The error correction used in QPSK had very little if any built in to combat multipath because of the very directional dish antenna used in satellite work.

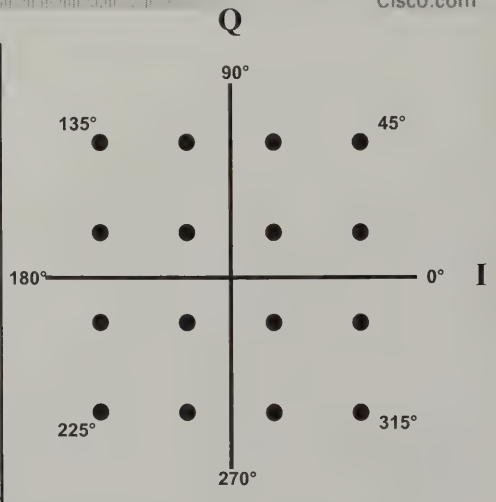
Although the size of the four levels in the constellation or boxes (it may be easier to picture it as) is large so QPSK can still be quite robust in moderate multipath conditions. Next we go from four boxes to 16 and we now have QAM 16 and four times more capacity that QPSK but also four times less room in the boxes and errors rapidly increase over the air. Additional error correction in both phase and amplitude is needed and uses some of the gained capacity. QAM 64 is also used but very tight tolerances must be observed. QAM 64 is usually limited to point to point microwave links and cable TV.

8VSB is the North American modulation standard used for DTV. It employs eight amplitude levels for its data channels and uses VSB filtering to remove most of the lower sideband of pulse amplitude modulated signal to conserve spectrum. It is capable of supporting a usable 19.3 megabit data stream. 8VSB

16-QAM Constellation

Cisco.com

Symbol Transmitted	Carrier Phase	Carrier Amplitude
0000	225°	0.33
0001	255°	0.75
0010	195°	0.75
0011	225°	1.0
0100	135°	0.33
0101	105°	0.75
0110	165°	0.75
0111	135°	1.0
1000	315°	0.33
1001	285°	0.75
1010	345°	0.75
1011	315°	1.0
1100	45°	0.33
1101	75°	0.75
1110	15°	0.75
1111	45°	1.0



requires about 6 to 8 dB less signal than analog VSB for grade A reception. 8VSB is sensitive to multipath and for the most part not allowing mobile use but the receivers now produced have much wider range error correction filters and a newer E-8VSB (enhanced) with forward error correction is now allowing portable 8VSB receivers to work.

COFDM is the standard in Europe and many other areas. It divides the spectrum into usually 2000 sub-carriers each modulated with smaller data streams to help overcome multipath, the guardbands between each subcarrier eat up more spectrum for the same usable data stream rate but works great with Europe's wider TV channel bandwidth than is available in North America. COFDM works well for mobile operation and is used in North America for Helicopter to studio links for reporting the news.

If you would like to look into the details of modulation, Wikipedia via the internet has most of the details.

Now that we have reviewed the world of modulation, what do we do? In my opinion we should ask ourselves what function we are looking to do.

Convert analog to digital transmit it then convert back to analog to display via NTSC, PAL or SECAM on our TV set or video monitor?

Do we want to obtain high definition ATV; most of the new camcorders are now HD format. Is standard definition on its way out in a few years and hence supply issues with analog cameras?

Do we want to still support analog and digital ATV at the same time (ATV repeaters) so some ATVers with analog and some with digital can still communicate?

Do we want a standard that can automatically support both standard definition and high definition without changing the transmitter or receiver?

Do we want to just have standard definition for talking heads narrow enough to fit into a 1 MHz channel?

Cost of digital equipment and conversion equipment for different standards, for example to convert high definition to standard definition for use at a repeater site to allow analog part of the system to transmit to ATVers that have not yet upgraded is a few thousand dollars.

When I look back to getting on ATV 35 years ago, I started with SSTV and after some excitement of working DX SSTV; I wanted real TV with full motion and great resolution. I also like building my own station too and at the time it was a techno geeks dream building a real TV station.

Over the years building ATV repeater and linking them to provide good picture over greater distance than simplex could provide was cool. I soon found out that the FM modulation used for the links could provide better resolution so then came 2441.5 MHz FM inputs to the repeaters. On one of our repeaters we added an FM output and with a high resolution camera and video monitor superior quality was obtained at the same time ATVers with regular definition cameras and monitors were compatible.

As a broadcast engineer I look to my experience with fixed and mobile TV to see in the real world what works well and what doesn't and apply it to ATV.

So far the best mobile video (Helicopter) modulation for robustness has been QPSK, surprising as COFDM was suppose to be the best for mobile ENG use. It does work well but when the signal does unlock, it can take 15 to 20 seconds to relock spoiling the shot. QPSK takes a second or two to relock. The drawback is QPSK on 12 MHz wide ENG channels support standard definition but not HD. A wider channel can support HD with QPSK.

8VSB is the most efficient for a data stream big enough to support full 1080 HD and some added room left over or two 720 streams or 5 standard streams.

Cost will most likely greatly help decide the way to go. HD Camcorders are now the cost of analog camcorders of a few years past and already have MPEG compression built in. A company AJA sells a brick size (a bit smaller than) converter to change HDMI output to ASI the digital video used to broadcast video over links and now many new broadcast transmitters take ASI as well as SEMPTE 310 digital streams to broadcast via 8VSB. Most QPSK or QAM 16 microwave links use ASI and ASI used standard 75 ohm coax and connectors. The AJA converter unit is reasonable cost.

Many of the QPSK satellite receivers used have ASI as well as the converter to analog built in. The new TVs now sold have 8VSB and QAM demodulators built in too. Home TVs now have 8VSB and QAM demodulators built in.

ATVQ

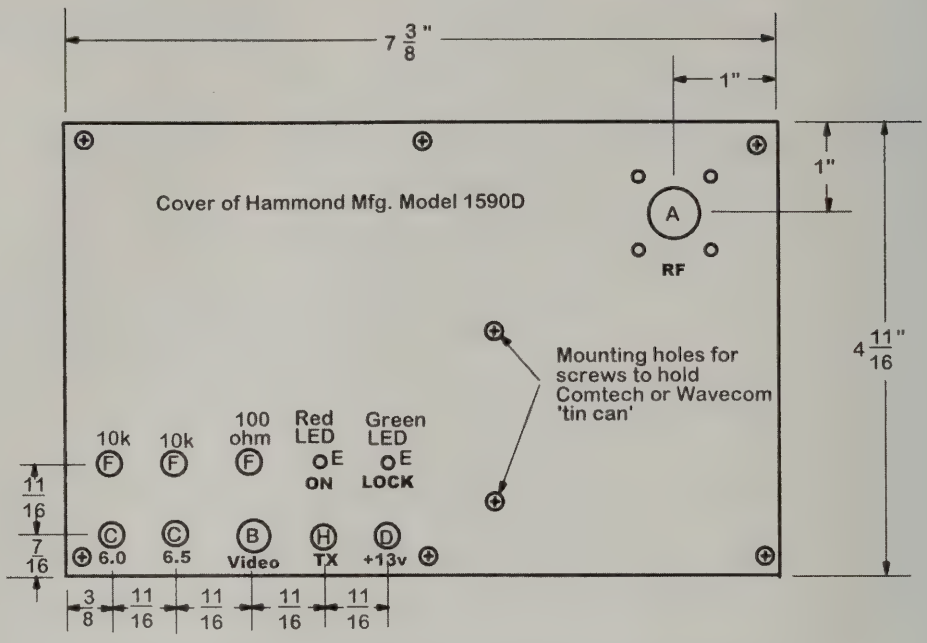
Stay tuned for more on DATV in the next ATVQ

Packaging ATV Repeater Equipment

- Mike Collis WA6SVT - drawings by Bob Miller W6KGE

Packaging ATV Repeater Equipment

When an ATV builder or group adds more repeaters, it becomes important to have a packaging system that is uniform throughout your network. Many years ago our group, ATN found ourselves with a growing problem of unique equipment at each site and at time substitute loaner equipment would not fit the rack space vacated by the bad unit.



Layout of cover for Link or FM Transmitter Box

Connector type and Hole Size:

A = Type 'N' connector for RF
Center hole is 1/2" dia.
4 outer holes are 3/32" dia.
spaced at 3/4" apart.

B = BNC connector for Video
hole is 3/8" dia.

C = RCA connector for audio
hole is 1/4" dia.

D = Feed-through
hole is 1/4" dia.

E = LED (light emitting diode)
hole is 1/8" dia.

F = Allen-Bradley TrimPot
hole is 5/16" dia.

H = Toggle switch
hole is 1/4" dia.

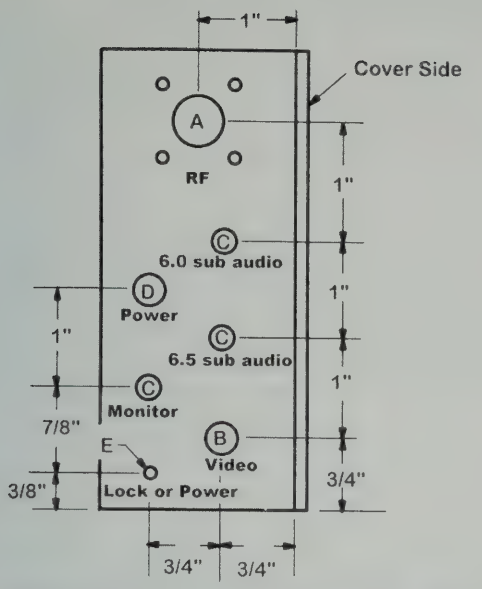
We came up with the following packaging standards that work well and reduce trips to the mountain top to place the repaired module back. We have eight linked repeater just in Southern California and others in several other states.

Repeater VSB exciters are CATV modulators modified with the up converter inside to allow 33 or 23 cm output. Change the video input connector from "F" to BNC, RF output BNC. Keyed VCC to turn on the modulator internal RF Brick via a relay, RCA jack and front panel LED added and labeled TX.

FM transmitter exciters are packed into a 1590D dicast aluminum box and controls, jacks, and exciter PCB or tin can on the front panel. Box mounted onto a 3 RU (5 ¼") 19" rack plate and usually mounted to the left side to allow a 5 to 10 watt amp on the right.

Receivers, PC Electronic AM and FM main and link receivers use the same box as above but the electronics are mounted to the box not the lid. The jacks and connections on one end of the box and the other side is drilled and tapped for 12-24 thread spaced 3 ¼" center to center to allow up to seven RX units to occupy a single 3 RU rack plate.

This makes a compact yet very easy removal for service packaging system. Our controllers use DB-9 female connectors for TX or RX units including 2 meter talkback and control radios. A single cable usually about 18 inches is fabricated as the connecting cord. The end at the exciter or receiver is RCA for audio and BNC for video and a male DB-9 for the end to plug into the con-



Connector end of Receiver Box

Connector type and Hole Size:

A = Type 'N' connector for RF
Center hole is 1/2" dia.
4 outer holes are 3/32" dia.
spaced at 3/4" apart.

B = BNC connector for Video
hole is 3/8" dia.

C = RCA connector for Audio and monitor.
hole is 1/4" dia.

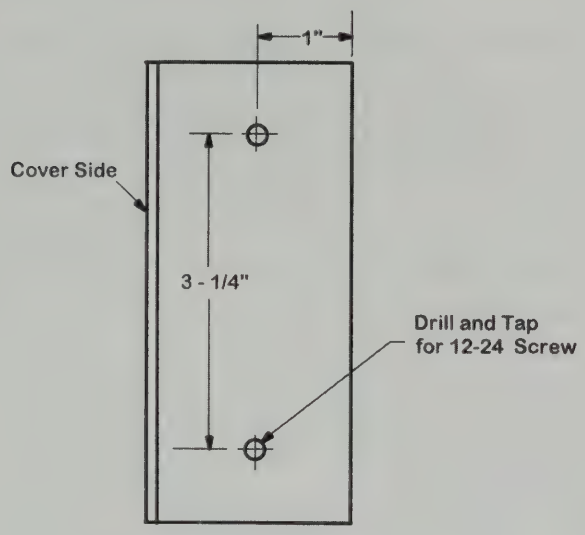
D = Coaxial Power connector
5.5 mm outer, 2.1 mm inner
hole is 3/8" dia.

E = LED (light emitting diode) for power or lock indication
hole is 1/8" dia.

troller. The pinouts are as follows:

1. Audio
2. Audio 2
3. xx
4. xx
5. Keyed 12 volts
6. Ground
7. xx
8. Video
9. +12 volts

Pins 3, 4 and seven are used for PTT, COS and F1/F2 use for 2 meter and control radios. The great thing here is if you accidentally plug an exciter into a receiver jack or vise versa, no damage to any unit or the controller. It is nice to have a working spare unit and take it to the mountain top and if needed set it to the correct channel and not worry about a

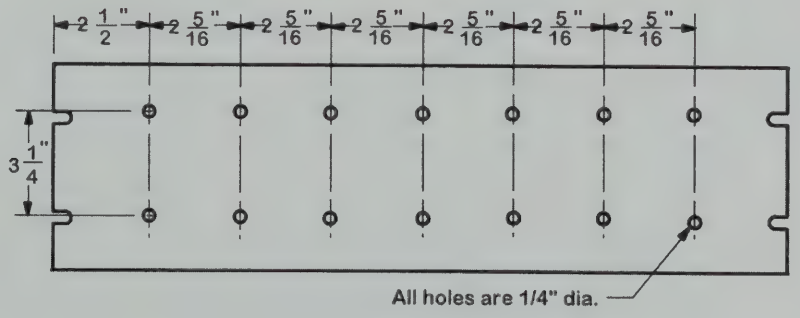


Mounting end of Box
Hammond Mfg. Model 1590D Diecast Box

second trip to bring the fixed module back, put the fixed unit in the spares shelf for the next site that needs it.

In ATN's case a single 2.4 GHz unit can work as a main 2441.5 MHz or 2417.5 MHz link receiver at any of our sites in any state, we have three states currently using the packaging system.

ATVQ



19" Rack Mount Panel
19" Rack Panel Plate, 3 Rack Units high (approx. 5 - 3/8" high)

ATV activities at Dayton Hamvention

ATV FRIDAY NIGHT DINNER May 14th, 2010:

The ATV Friday night dinner and discussion will be held on Hamvention Friday from 7 till 10PM at Roush's Restaurant 305 W Main St. in Fairborn, OH 45324 (at north end of Wright Patterson airfield runway). The dinner menu is varied, moderately priced and ordered separately. We will enjoy a sit down dinner then have speakers talk about various ATV topics. We will also include door prizes for those present. The meeting terminates at about 10PM.

Directions: Take I-75 north then I-70 east. Exit SR 235/ SR4 south (Fairborn exit). South on 235 about 1 mile then left on Chambersburg Road (east & still SR235 past airport runway). Right on N. Broad Street for about 10 blocks. Left on W. Main Street for 3 blocks to Miller Ave. Roush's is on corner of W. Main and Miller. Parking in rear.

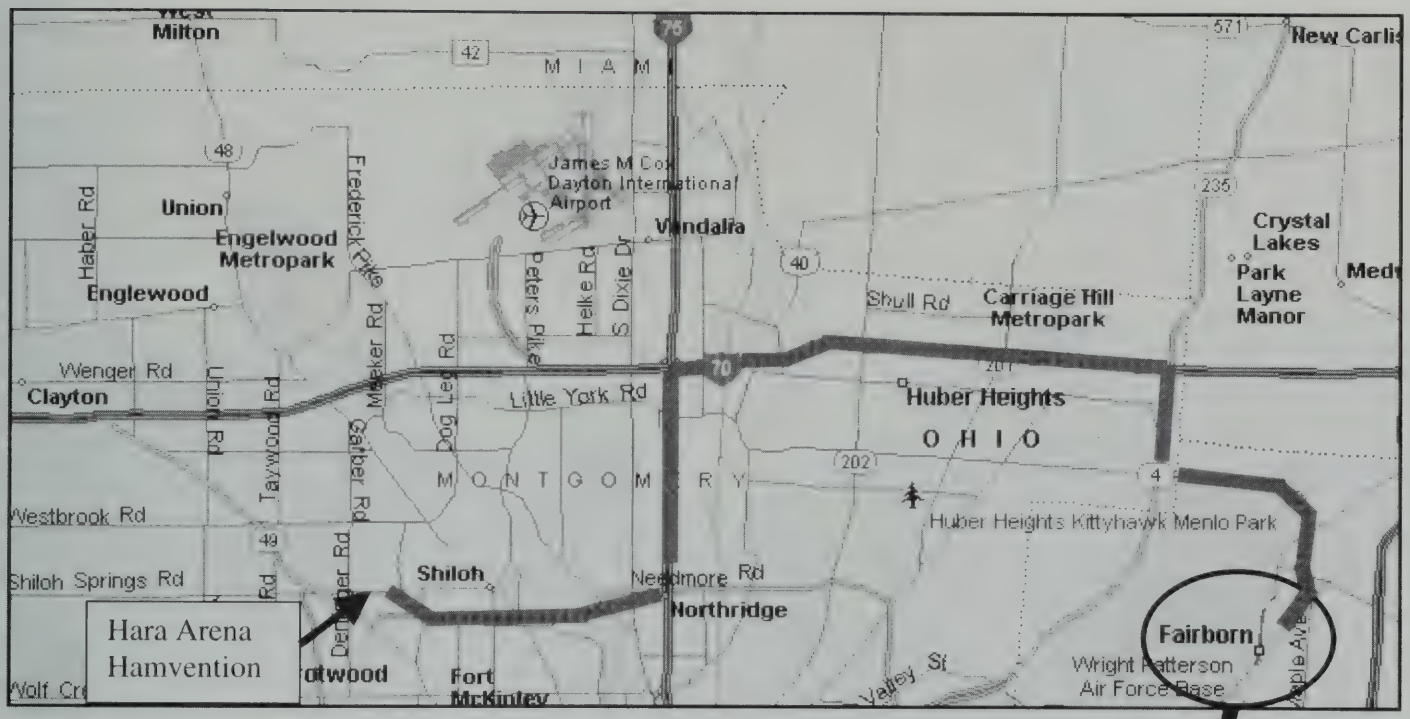
Saturday at the Hamvention:

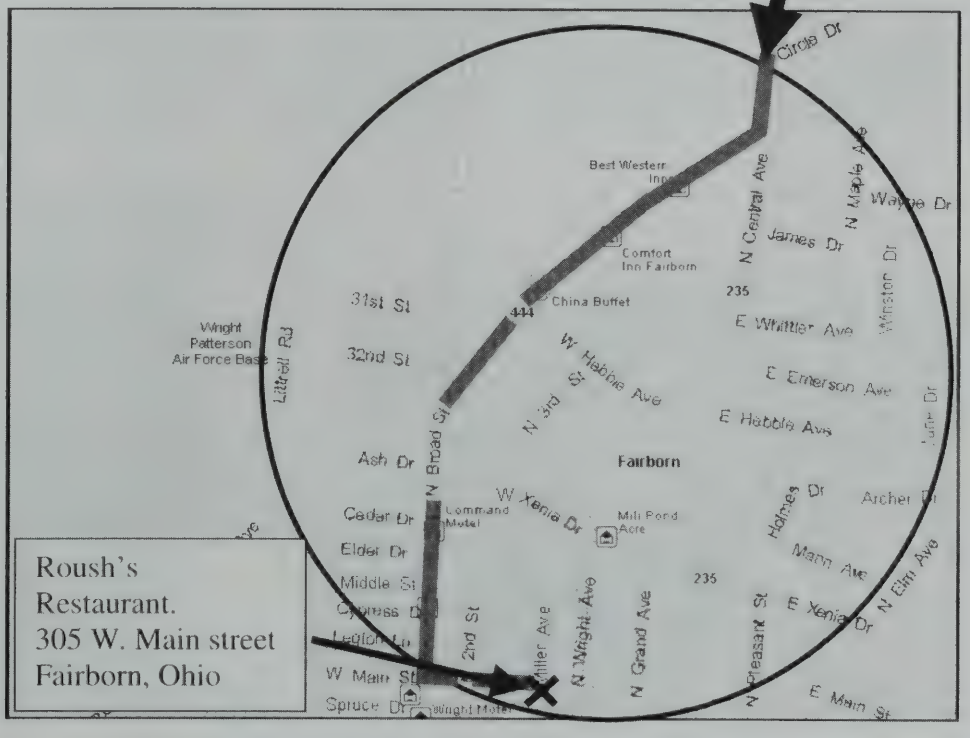
1530-1700 3:30-5:00PM ROOM 2 ATV (FAST SCAN AMATEUR TELEVISION) FORUM

TIME	SPEAKER / CALL	PRESENTATION TOPIC
1530-1535	Art Towslee WA8RMC	Introduction/"ATCO repeater update"
1537-1552	Gordon West WB6NOA	"Dress up for live demos"
1554-1559	Ron Cohen K3ZKO	"Philadelphia, PA repeater update"
1601-1611	Mike Collis WA6SVT and Bill Brown WB8ELK	"ATN California repeater update and ATVQ Magazine"
1613-1621	Ron Fredricks K8DMR	"Grand Rapids, Mich. repeater update"
1623-1628	Jess Nicely KB8OFF	"Dayton, Ohio repeater update"
1630-1700	Ralph Taggart WB8DQT	"An Amateur's Life in ATV/Image Communications"

ATV Friday Night Dinner 2010 **The ATV Friday night dinner and discussion will be held on Hamvention Friday from 7 till 10PM at Roush's Restaurant 305 W Main St. in Fairborn, OH 45324 (at the north end of Wright Patterson airfield runway). The dinner menu is varied, moderately priced and ordered separately. We will enjoy a sit down dinner then have speakers talk about various ATV topics. We will also include door prizes for those present. The meeting terminates at about 10PM.**

Directions: Take I-75 north then I-70 east. Exit SR 235/ SR4 south (Fairborn exit). South on 235 about 1 mile then left on Chambersburg Road (east & still SR235 past airport runway). Right on N. Broad Street for about 10 blocks. Turn left on W. Main Street for 3 blocks to Miller Ave. Roush's is on corner of W. Main and Miller. Parking in rear. Roush's Restaurant. 305 W. Main street, Fairborn, OH 1-937-878-3611 GPS (39-49-19-N) X (84-01-30-W)





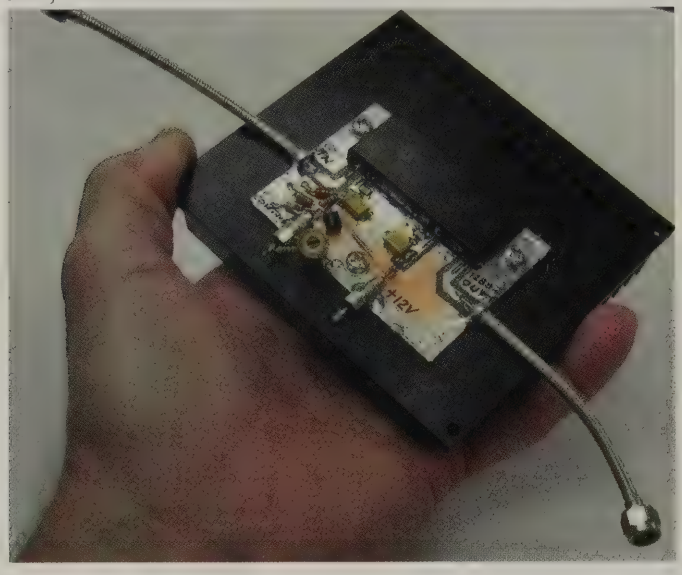
BUILD A POWER AMP FOR 1280 MHZ ATV

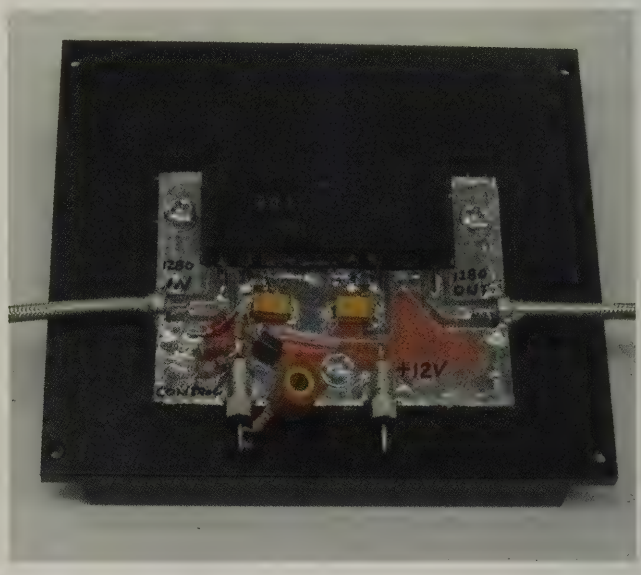
A few years ago I presented a 900/1200MHz power amp design in the ATCO Newsletter for use in the ATCO/DARA video link between Dayton and Columbus, Ohio. That design involved a significant amount of machining on my part (I like to do that and sometimes get carried away) but not very easily duplicated by others. Recently, a friend of mine asked if I would build a 1200MHz amp if he gave me the Mitsubishi RA18H1213G brick (about $75 at RF Parts Inc). Since I couldn't resist the urge to create yet another version, the pictures below represent my latest effort.

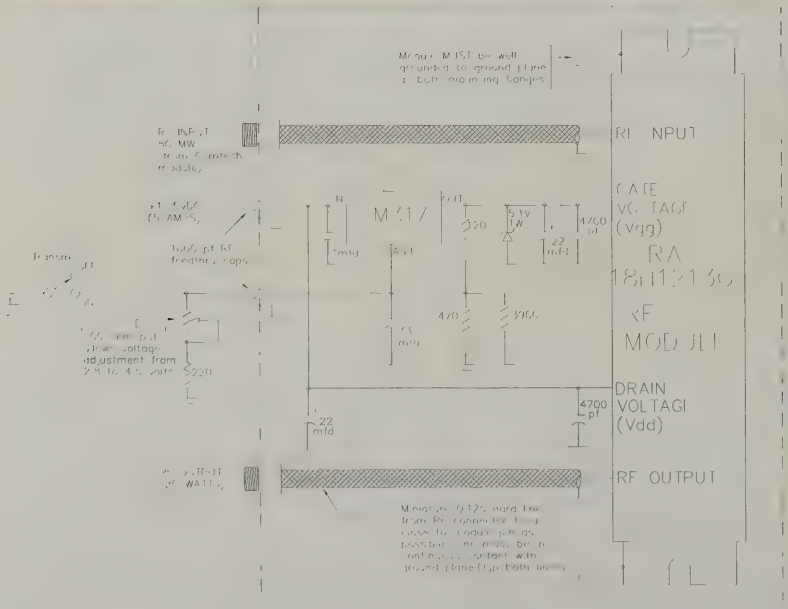
After I finished the newer design, I realized I could have used some of my previous design efforts (shown on the following page) and employed a brass sheet instead of the printed circuit version which needs thin brass shim pieces soldered to the bottom and top of the circuit board all around the edges to create a low impedance ground plane. I created the printed circuit board traces with an X-Acto knife to carve out the input and output lines but could have connected the hard line directly to the brick input and output as in the older design. I show both designs in order to give the builder a design choice.

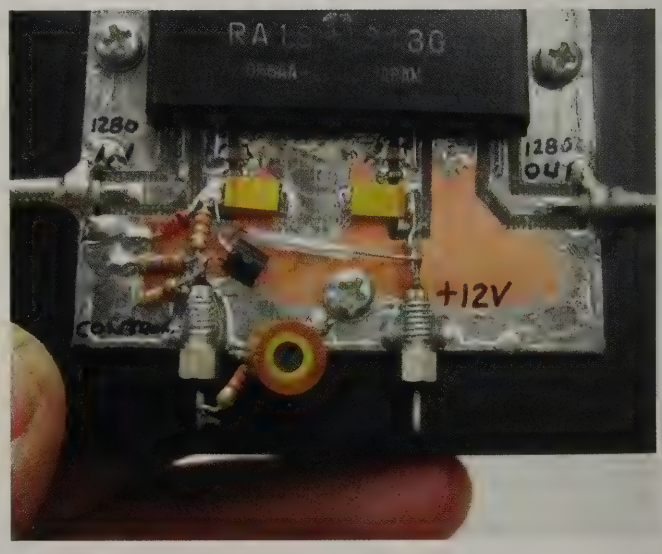
In either case, it's of the utmost importance to connect the brick mounting tabs directly to the ground plane. Notice the circuit board (or shim stock) extends around the brick sides to mount to the brick mounting screws. I machined a 0.060" deep recess in the heat sink for the brick so the circuit board will lie flush but it would be just as good to mount the brick on a non-recessed surface and space the circuit board up a little above the heat sink surface. The LM317 regulator may be either the TO220 style or the LM317LZ low power unit because the "gate" terminal draws only about 2Ma. The 5.1V zener is for protection in case the gate voltage goes above 5V.

The "control" input allows grounding it to turn the amp off or use a pot to adjust the output. I used a Comtech board for the drive (~50-80mw) which delivers over 20 watts out if needed. At 20 watts the brick requires about 5 Amps at 12 volts. For 10 watts out, it is about 4 amps. As shown with this heat sink, a fan is most definitely required. For the earlier design, because of the size of the heat sink, no fan was used.



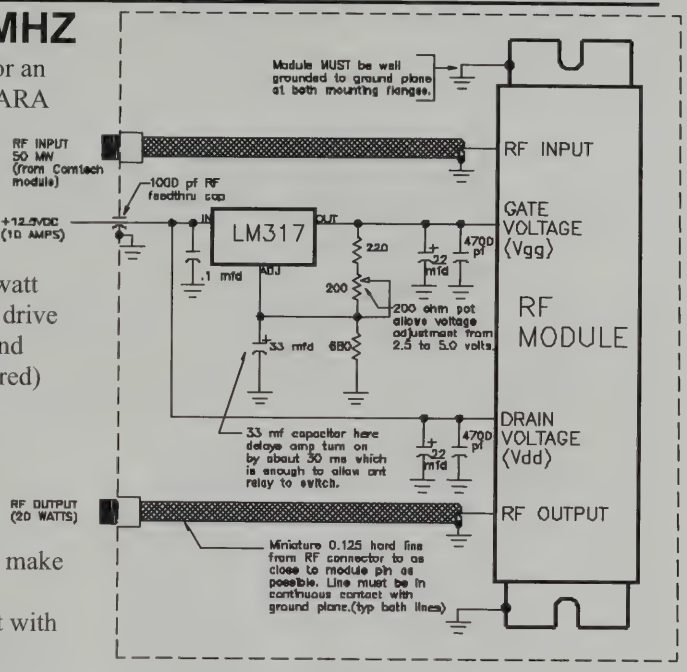






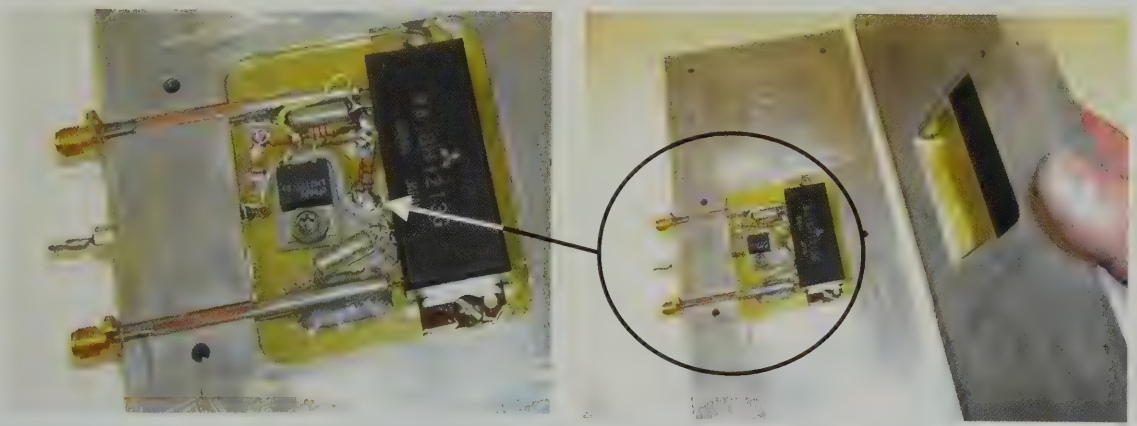
BUILD A POWER AMP FOR 900/1200 MHZ

During the ATCO/DARA link transmitter design phase, I was looking for an easy, simple and reliable way to create both a 915 MHz signal for the DARA repeater and also a 1280 MHz signal for the ATCO repeater. Both needed to be in excess of 10 watts. The search revealed two relatively new brick devices from Mitsubishi, the RA18H1213G for 1240 to 1300 MHz and the RA20H8994M for 896 to 941 MHz. Both devices cost about $73.00 each from RF Parts and perform far better than I expected. Both will provide in excess of 20 watts driven from a 50 milliwatt source. That's perfect for I wanted to use the Comtech demo modules to drive them without an intermediate amp. The result is an extremely compact and simple combination where a 1 volt NTSC video and audio (stereo if desired) signal is fed into the Comtech module for an output of 20 watts RF FM modulated signal.

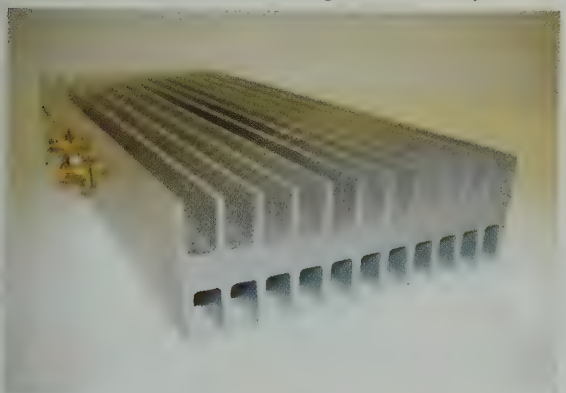


The construction is as simple as could be expected for these types of components. However, good RF construction techniques must be observed. If you haven't built things like this before, either don't do it or make sure you have an experienced friend handy for advice. All possible considerations and cautions cannot be covered here so it's best to consult with an experienced builder before starting.

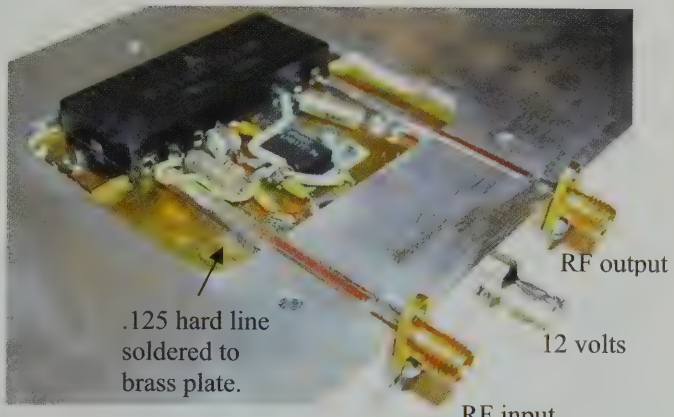
Good heat sinking is paramount for the bricks are only about 25 to 30% efficient. For an input power of 12 volts @10 amps (that's about 120 watts), about 84 watts will help heat the ham shack. If a good heat sink is not used, all may go up in smoke. Next it's very important to provide a good ground plane for RF. Instead of using a PC board, I used a piece of brass 0.010" shim stock from the hardware store, mounted everything on it including the Mitsubishi brick making sure the brick mounting tabs are in good contact with the brass and coated the bottom with heat sink compound. All components are "dead bug" mounted to the brass also, even the hard line where I soldered it the entire length to the brass. The photos below show it better than I can describe so check it out closely.



A few words about the operation: The pot as shown provides RF output control where output begins at about 3 volts and exceeds 20 watts at 5.0 volts.(**Do not exceed 5 volts on the Vgg line**). The 33 mf capacitor in my case allowed a 30 ms delay in RF output upon 12 volt power to allow the antenna relay to switch. (I don't like open loop control but have no relay feedback so…). The LM317 regulator should be the TO220 mounting style because it does get slightly warm (don't ground the mounting tab. It's connected to Vout). The resistor divider for voltage adjustment can be altered to suit your resistor and pot selection. Just remember that the LM317 will regulate the output to maintain 1.35 volts from out to Vadj. Higher values will lengthen the delay to on determined by the 33 mf capacitor.



On the left is the finished amp. I used two heat sinks with each half milled out to fit the components. You don't have to get this elaborate. I just get carried away at the milling machine sometimes.



…WA8RMC

Television Timeline - part 3

The 30's

- Denise Camp

Patents and Productions 1931-1941

Even Philo Farnsworth, who was primarily interested in the scientific development of television, entered the patent dispute taking on the big guy, RCA. RCA had boasted they'd never had to pay a patent in radio and they planned to keep it that way with television. Companies like Westinghouse, General Electric as well as RCA funded scientists in the electronic television race trying to beat their competition. There were many other focused inventors, like Edwin Armstrong. Add scientist/engineer Lee DeForest who took a "shot gun" approach to science and was always seeking patents for one invention or another, and the patent wars had begun.

Worldwide Television was evolving. Great Britain, Germany, Japan, and the United States, were on fire to make better televisions and make them available to the public. That fire was dampened when WWII began. Development abruptly stopped so nations could concentrate on the war effort. There was some broadcasting still in the United States but no new productions. Great Britain ceased broadcasting and production.

1931

John Baird demonstrated "Zone Television" which showed full length figures and a cricket lesson. He scanned lines vertically, not horizontally, using a 30-line system resulting in a picture that was the shape of a narrow, vertical rectangle using an image (portrait image) three-units wide by seven high.

Lee De Forest filed a U.S Patent for a method of recording pictures, film or events at the receiver " by the etching action of an electrical discharge upon a suitable coating applied to a moving picture film or strip. The variable impulses of a video signal activated a series of needle points arranged around a revolving wheel. The varying pressure of the needle points on the surface of a 35mm film coated with pure metallic silver etched the image onto the film, which can then be displayed by means of a conventional motion picture projector". It was part of a project to develop large screen television mechanism to project full size motion pictures. This was abandoned due to the Depression.

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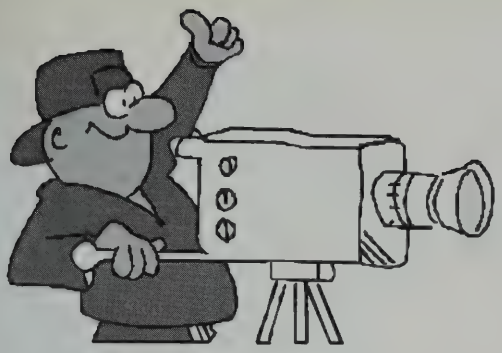

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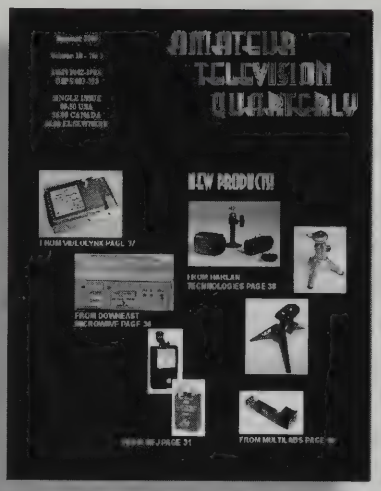

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ATV Secrets is a great place to start your ATV adventure! Volume I has 64 pages, tightly packed with information covering all aspects of getting started, where to find activity,equipment, how to DX, and answers frequently asked questions about power, antennas, vestigial sideband operation and more. Everything the beginner in ATV needs!

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Volume II is sold out in the paper version, but available on CD.

ATV Secrets Volume One (paper) $8.95
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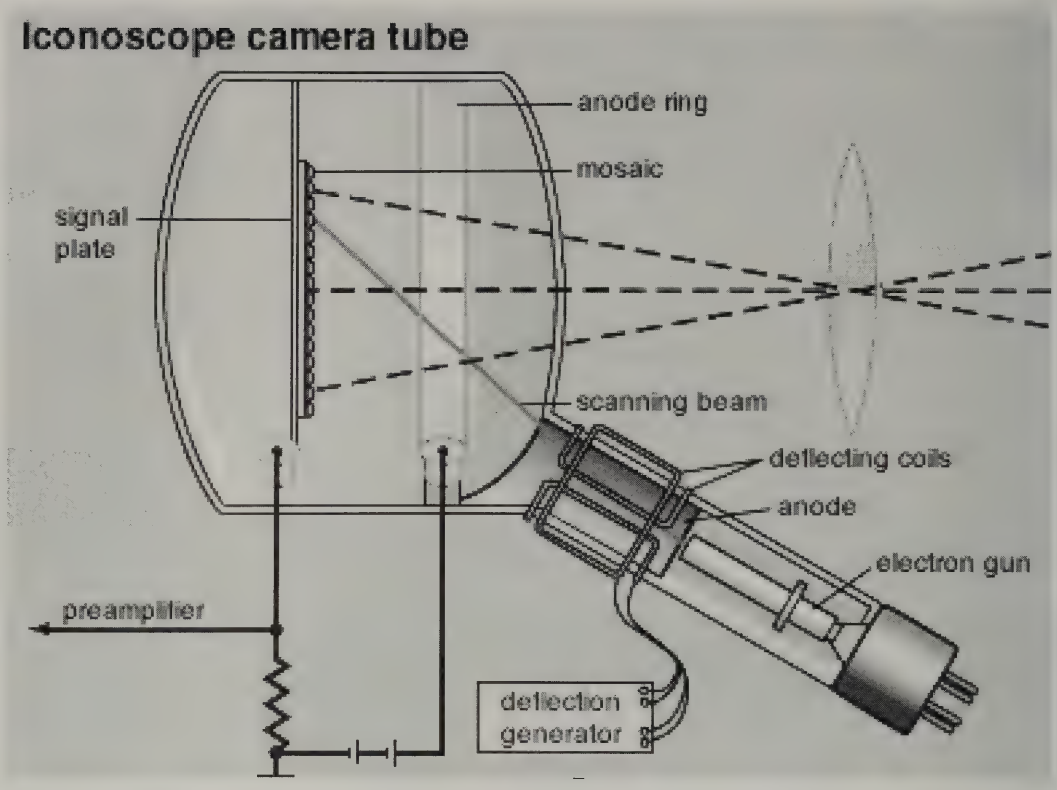
France began to broadcast from the PTT building in Paris (and the Eiffel tower in 1936) using 180 line Nipkow disk camera.



Russia was introduced to television. TV stations were on the air in Leningrad (240 lines) and Moscow (343 lines) in the late 30s.

Baird Junior Kits were available for purchase in Great Britain. It included "Essential components for Television." Those components included Scanning Discs, Noon lamp holders, Synchronizing Gear, and a Motor. Baird Ltd. was trying to capitalize and extend potential audiences. It was an efficient way to receive the test broadcasts that had come out the year before.

A Flying spot was shown by Manfred Von Ardenne in his cathode-ray tube at the Berlin Radio show, inaugurating the development of electronic television in Germany.

1932

A Coated magnetic tape was developed by the German Firm IG Farben.
Allan B DuMont left the DeForest Company to set up his own business researching and marketing cathode ray tubes and oscilloscopes.

Ultra short wave (7.3) television was demonstrated in April according to the BBC
120-line television was demonstrated by RCA on a cathode ray tube with better result achieved by scanning film than by direct imaging.

1933

Frequency Modulation (FM) was introduced by Edwin Armstrong. This was a static-free method of transmission.
An all electric television was field tested in Camden, NJ using a video transmitter and connected by a coaxial line.

RCA 1850A Iconscope Tube

Iconoscopes (television cameras) were used to pick up a bath scen both in the studio and out-of doors. A scanning pattern of 240 lines made it possible to obtain a picture with good definition,

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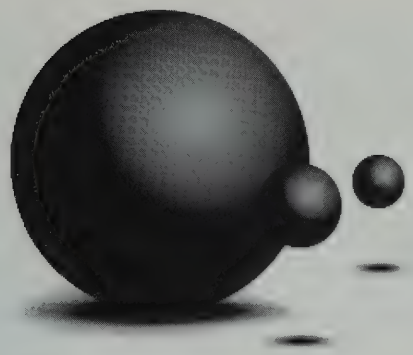

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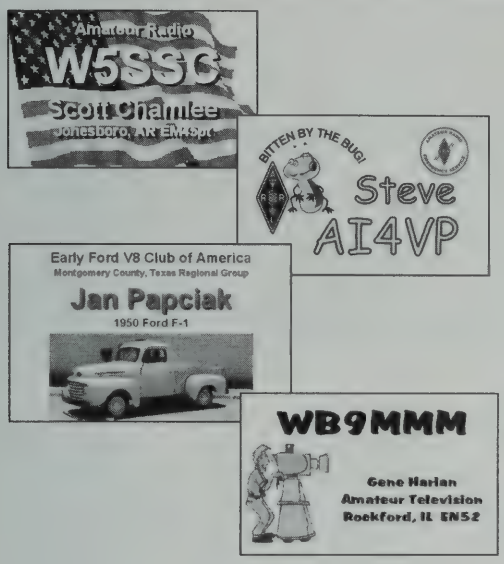

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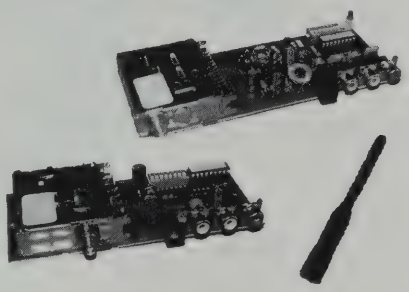

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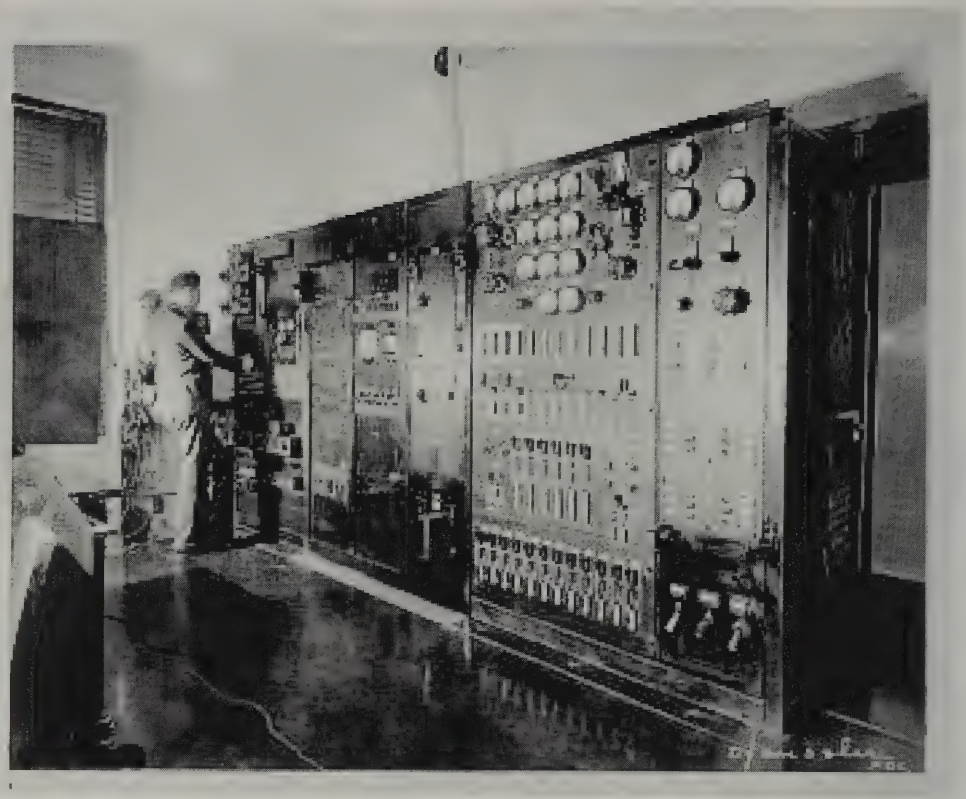
but as the frame frequency was 24 cycles, without interlacing, flicker was quite noticeable.

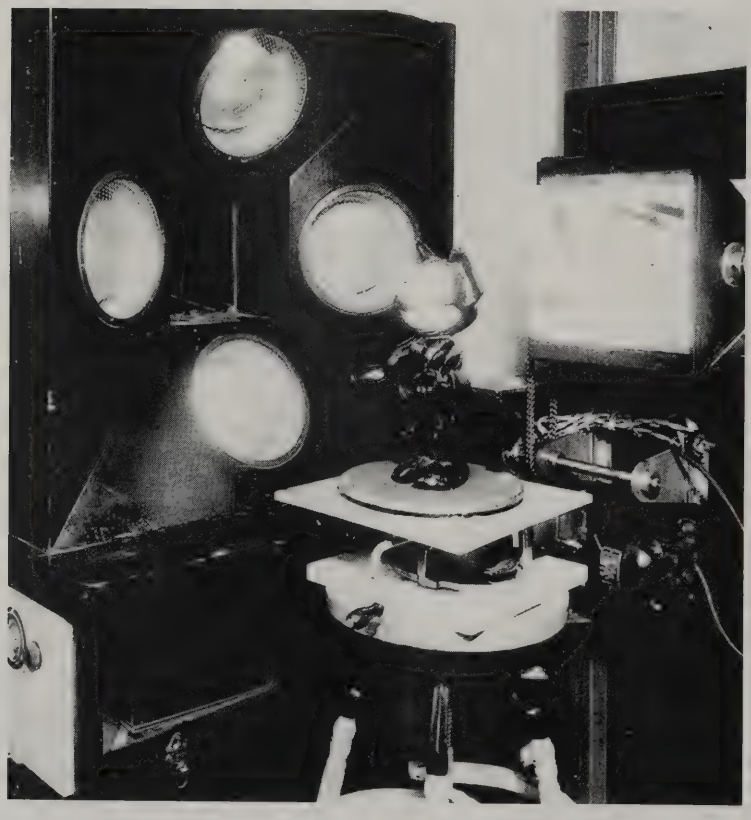
Edwin Armstrong introduced Frequency Modulation (FM) a static free method of transmission.
President Franklin Roosevelt broadcast to the nation.

All electric televisions were field test in Camden, NJ, using a video transmitter and connected by a coaxial line.
Iconoscopes (television cameras) were used to pick up scenes both in the studio and out-of-doors. A scanning patter of 240 lines made it possible to obtain a picture with good definition.



NBC's transmitter site at the Empire State Building

The frame frequency was 24 cycles without interlacing so the flicker was noticeable.



W2XBS broadcast of Felix the Cat

1934

The First use of television in astronomy happened in August when Philo T. Farnsworth, at age 28, produced a televised picture of the moon
The Federal Communications Commission (FCC) was created. This regulates broadcasting even today.
343 lines of resolution @60 cycles with 30 interlaced fields to reduce flicker was used by RCA, with a repetition of 30 frames per second. This adoption of a new system improved upon Zworykin's electron system .

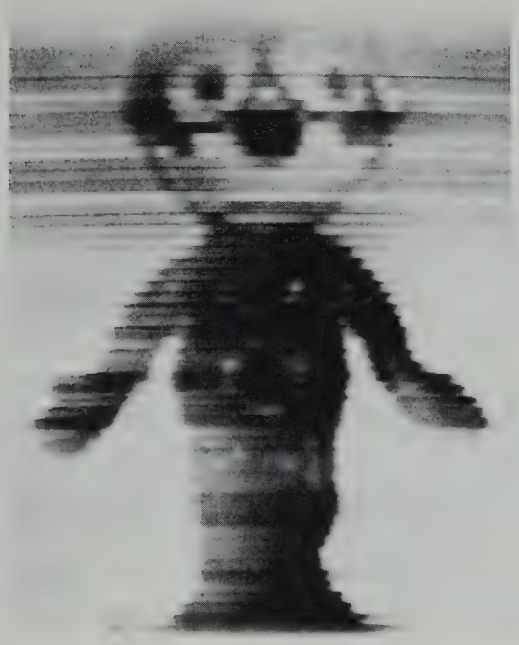
1935

The Empire State building became the site of a transmitter placed one of the upper floors with 1285 feet antenna above street level.
RCA relocated its experiments , a transmitter was placed on one of the upper floors. Two

links interconnected the studio and transmitter. An ultra high frequency radio link operating @ 177megacycles served as an alternative for interconnecting the two units. RCA relocated its experiments here because of good results.

The 240 line system by Baird vs.the 405 line system of EMI began. The BBC formed a committee that recommended this path of trial broadcasts.. For three months, the systems were to be alternated on a weekly basis, to determine which was superior. A 1935 Popular Mechanics article describes the competition.
Germany: The German Reichpost (post office) began "the first television broadcasting service in the world" (German propaganda).

The Blockfernseher that they used was a television receiver without a VHF tuner. The quality was poor. They used 180 lines using only



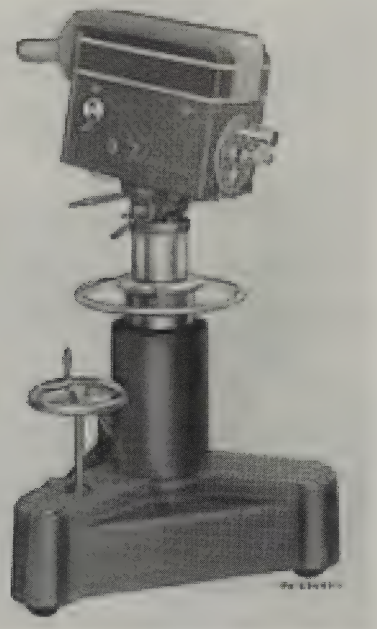
Off the air reception of Felix the Cat

Cont. on Page 26

telecine transmission of film and an intermediate film system. A public viewing room seating 100 people was used with a 4 foot by 3 foot screen was used.

The video was distributed over a high frequency cable at a 4.2 MHz carrier frequency. Audio was sent at 315 kHz or on a separate cable. At the public viewing areas, the video signal was up converted to the TV set's IF frequency of 8.4 mHz. The signal was applied to the first IF amplifier. Within each receiver, the synchronizing signals were extracted. The first attempts using cable transmission were made in 1936 with the 180 line television system and the carrier frequency was 1.2 mHz. The telephone network was used to transmit the video.

Early RCA Kinescope Tube



RCA Studio TV camera circa 1938

1936

The Coaxial cable was introduced. The first experimental lines were laid by AT&T between New York and Philadelphia.
The first real television program was shown by RCA.

Varian brothers with their first Klystron Tube

It included dancing, a film on locomotives, a Bonwit Teller fashion show, and a monologue from Tobacco Road.
High-definition television was first transmitted

from Alexandra Palace in North London by the BBC.
Three hours of programming was begun by the BBC with 3 hours of programming a day using 405 lines.
An electronic 406 line system was used by a broadcast in London
Plasma Televisions, the first flat panel system, was described in principle by Kalman Tihanyl.

A 343 line system was used by NBC to broadcast from the Empire State Building.
Philco demonstrated a 345 line system on a 9-1/2 by 7-1/2 inch television screen
The Olympic Games in Germany was broadcast using a 180 line electronic system.

First Remote Mobile TV - 1939

The World's Fair opened on W2XBS with FDR speaking.
RCA introduced its first commercial television set. It was the mirror-in-the-lid TRK-12 for $600.

1937

CBS began TV development.
High definition broadcasts are started by BBC in London.

The Klystron tube, a high frequency amplifier for generating microwaves, was introduced by brothers Rusell and Sigurd Varian. It is considered the technology that makes UHF-TV possible because it gives the ability to generate the high power required in this spectrum.

A large screen television was demonstrated by R R Law and Dr Vladimir Zworykin of RCA to the Institute of Radio Engineers in the USA. The projector uses a Kinescope tube, the designers recognized that a different type of tube is needed for projection television than for domestic receivers.

Cont. on Page 28

1938

The First color television was demonstrated at the Dominion Theatre in London by Baird. He used a two color process with 120 line interlaced pictures on a 12 foot by 9 foot screen. The BBC was no longer supporting Baird.
The first electronic television system was patented.
The 405 line Marconi-EM system was adopted by the BBC, leaving, leaving Baird's 240 line mechanical system.
Seven channels was allocated by the FCC allocated in the 44-108 MHz band and 12 channels in the 156 -294 MHz band.
CBS aired "World News Round UP " for the first time.

Allen B. DuMont manufactured a 14 inch electronic television set supervisor to the 12 inch set being developed by RCA. (1938 and 1939)
Outdoor and indoor transmissions from remote points was begun by NBC/RCA. This increased the flexibility of experimental television. They used a mobile unit that consisted of a pickup truck and transmitter, which operated @177 megacycles. One hundred receivers were built and located at various points within a fifty mile radius.

1939 DuMont 14" TV Receiver

1939

Television was demonstrated at the New York World's Fair and the San Francisco Golden Gate International.
Experimental broadcasts were conducted from the Empire State Building by Vladimir Zworkin and RCA.
Philo Farnsworth premiered his television. He sold his patent to RCA Victor for one million dollars.

1940

CBS demonstrated color television on WBNT.
The first regularly operation television station debuted in New York with an estimated 10,000 viewers.
A high definition color television receiver was developed by JL Baird. No longer with the BBC he had to finance it from his own savings. It projected an image 2.5ftX2ft onto a screen.

A 441-line large-screen television was demonstrated by RCA producing a 15ft x 20ft image, using reflective optics at the New Yorker Theatre.
A Madison Square Garden fight and Brooklyn Dodgers baseball game are shown.
And last but by no means least, the first Bugs Bunny cartoon aired.

ATV Low Pass Filter

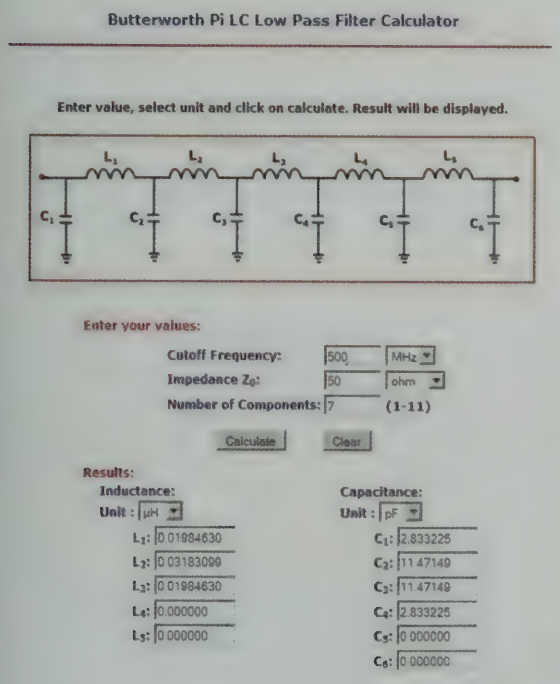
- Art Towslee WA8RMC (Reprinted from ATCO Newsletter Vol27_1)

Here's a handy filter for ATV applications. In my case, I needed a filter to eliminate the 3rd harmonic energy from the repeater 427MHz output. Why? Well, when I do the math, 427.25MHz x 3 = 1281.75MHz which is within the passband of our 1280MHz repeater input. Since the 427 output is on when receiving 1280, a small amount of 1280 desense occurred. It was not bad but took a 1280 input of at least P2 to be received. Therefore a filter that passes 427 but blocks 1281 was needed. The filter below filled the requirements. It was placed between the 427 driver and final amplifier since the amplifier is a true class "A" device. (If we still used a Mirage amp, it would have been needed at the amp output because the Mirage generated a lot of intermodulation distortion).

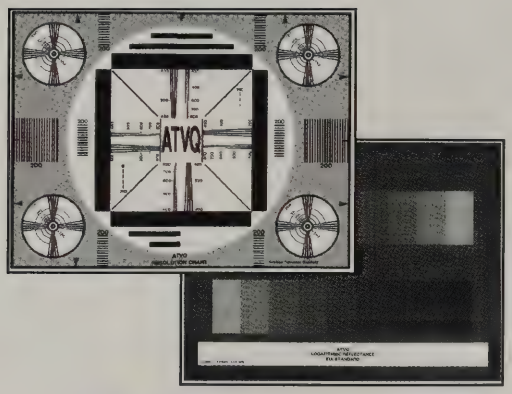
The filter was created with the help of a web based program at www.calculatoredge.com/electronics/bw%20pi%20low%20pass.htm which contains a whole library of useful engineering type programs. Simply bring up the web page, select the filter of choice, enter the information and press ENTER. The program does the rest. I chose ~500MHz as the cutoff frequency because it was sufficiently above 427 but well below 1280 and 7 elements because I thought it would produce a steep enough attenuation slope to get to the noise floor before getting to 1280. It turned out ok with those assumptions. The only tricky thing is how to estimate the inductance values as they calculate to be below 1 microhenry. Here I guessed based upon inductors I have made in the past. (The filter side walls also affect it). The capacitors were easy because I used 1-15pf variable piston trimmers. That way I could fine tune it with the aid of a spectrum analyzer.

The pictures below illustrate the final design. The chart at the lower left is what the "CalculatorEdge" program displays. The analyzer picture below displays the signal attenuation as frequency increases. Housing material is printed circuit board stock. Tested results are as follows: loss through filter @ 427MHz = 0.1dB and >80dB @1280MHz.

I made a low pass filter but there are formulas for high pass and band pass also. In fact you can combine a low pass, band pass and high pass filter to create a 3 port band splitter if you like. Diamond and Comet both sell port splitters using formulas like this so now you can roll your own. If you need to verify the design, bring it over and I'll connect it to my spectrum analyzer!
…WA8RMC



FULL COLOR TEST CHART



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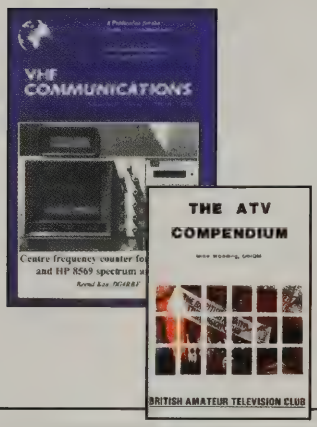

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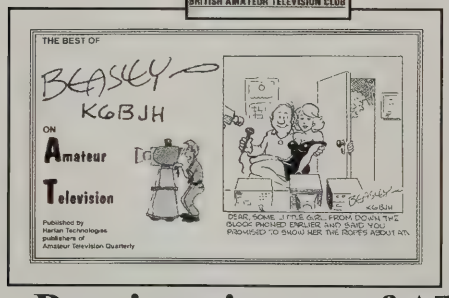

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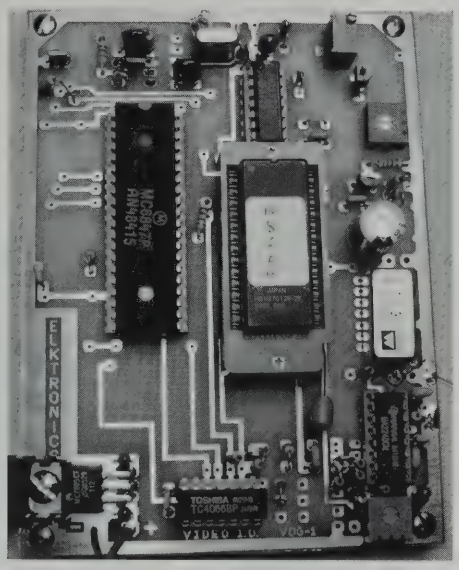

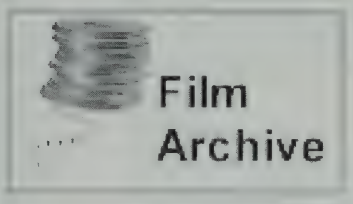

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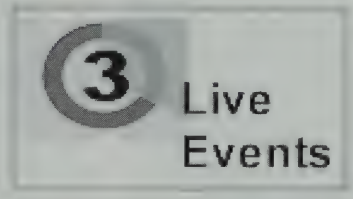

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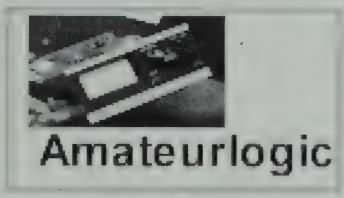

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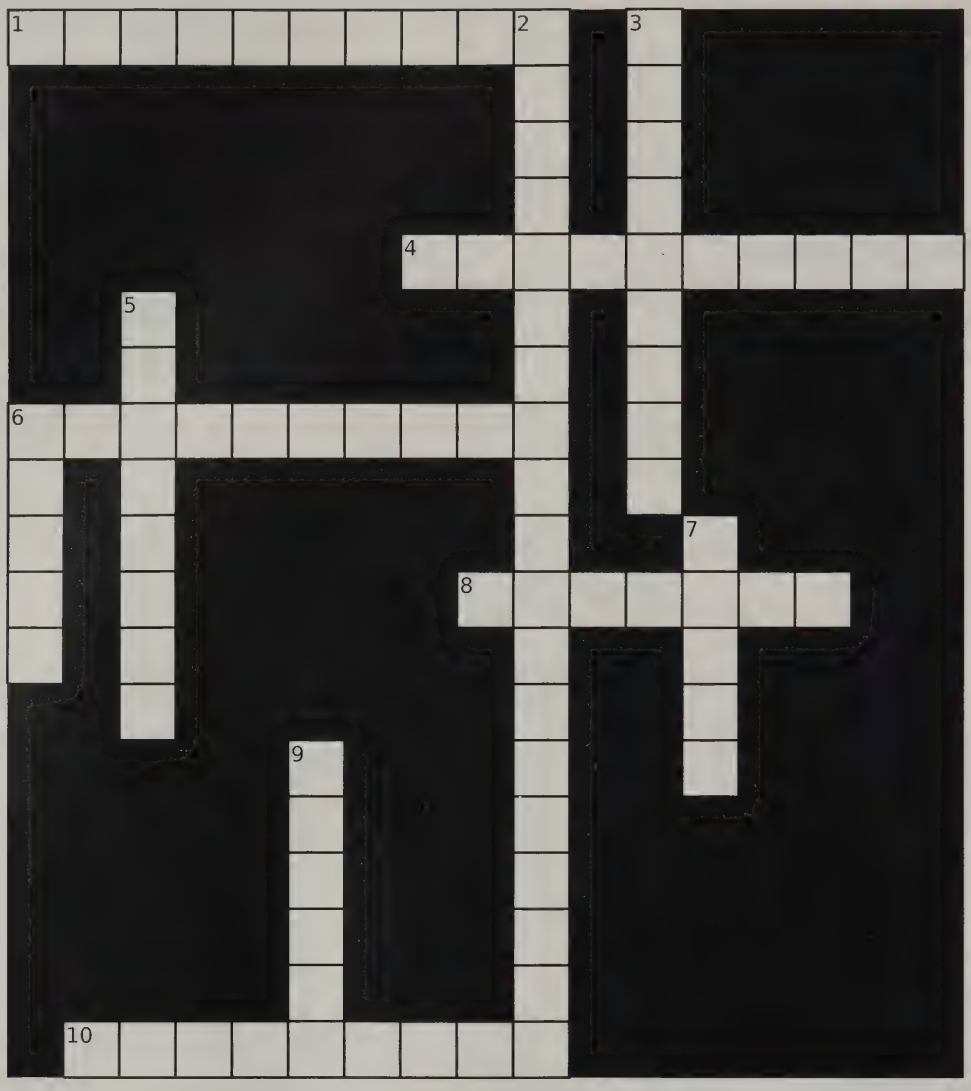
Early TV Inventions

Denise Camp

Inventions and Inventors that made Television possible



Across

1 Early TV camera tube
4 RCA bought his patent for television for 1 million dollars in 1939
6 Manfred Von Ardenne's method of scanning film and images using a CRT (two words)
8 Country where first Olympics were televised
10 Inventor of FM modulation

Down

2 Location of first skyscaper TV broadcasts (3 words)
3 Early RCA picture tube
5 Varian Brother's Invention
6 Famous cat television star
7 Maker of The Junior Kit scanning disk TV system
9 This company made a 14" TV set in 1939

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Article submissions can be sent to:

Bill Brown WB8ELK
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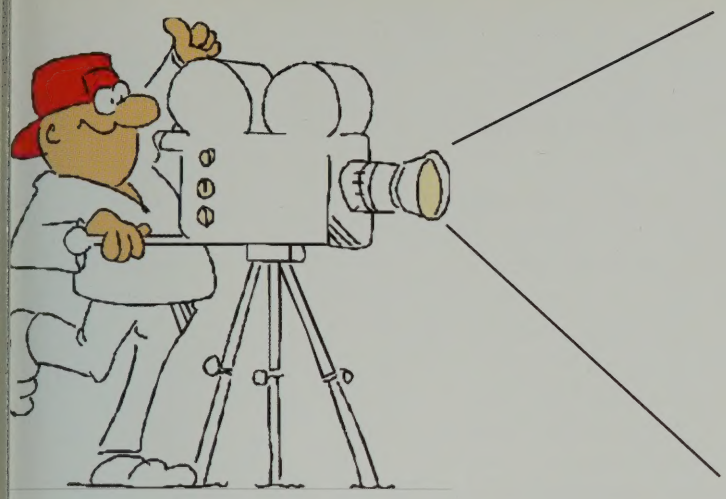
or to our email address: **wb8elk@atvquarterly.com**
Also note our web page address: **http://www.atvquarterly.com**

Payment for Technical Articles

ATVQ will pay for certain articles that it publishes. I will outline the policy here, but it will be subject to change as needed to make sure that ATVQ continues to be an ongoing publication. ATVQ will pay $25.00 for technical articles that are published and are a minimum of 2 pages. While this is not a great amount, I hope it will encourage more technical type articles to be written. Exceptions will be articles that are written by a manufacturer/seller of equipment that is being written about. While I do not want to discourage this type of article, the article itself is an advertisement of the product. Articles from clubs will be encouraged, and I would expect they would like to share their information with the ATVQ readership. Information gathered from the Internet will not be paid for and is mostly small filler items.

Ideas

Do you have an idea for an article that you've said to yourself that you wanted to write, but never did. Feel free to check with us to see if it is of interest, or write and send it in. No guarantees that it will get published, but if you don't try, you will never know. I'll be looking to see what you can do!



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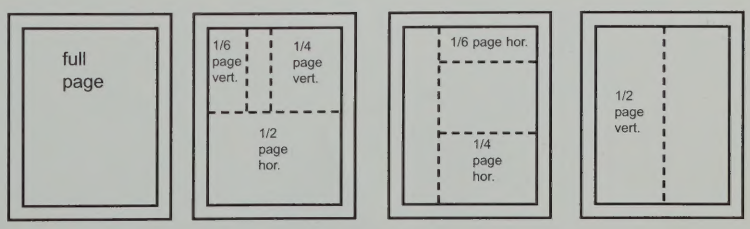

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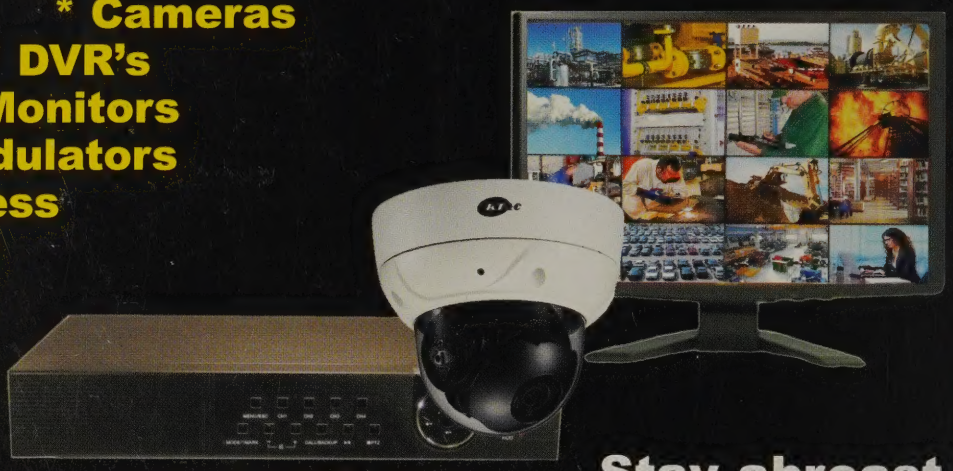

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